25X1A

25X1A [redacted] #1249
R E G I S T E R E D

9 September 1966

DECLASS REVIEW by NIMA/DOD

25X1A [redacted]
Colonel, USAF
Assistant for Plans and Development, NPIC

25X1A Subject: [redacted] Digitizer Interferometer Modifications Applicable to Model 405B Chip Comparator

Reference: a) [redacted] letter dated 8 July 1966

25X1A b) [redacted] letter #1237 dated 22 July 1966

25X1A Dear [redacted]

In accordance with our letter, reference (b), we stated that our test program on possible "fixes" to improve the stability of the Interferometer was to be completed at the end of August. We also stated that we would report to you of our results at that time. We have completed our test program and achieved the results expected. A summary of our testing and results are given below.

"TEST PROGRAM

A) Temperature Regulation

Brief study was given to temperature regulation by means of a proportional controller purchased from [redacted] 25X1A
25X1A [redacted] No serious problems showed up initially, but further consideration indicated that illumination control would be more satisfactory. Control of illumination would regulate temperature to compensate for the variations of RF generator output.

B) Illumination Control

A control circuit was breadboarded and temperature checked on the bench with a heat gun. The circuit was designed for use with a Clairex type CL705 photoconductive cell. Although the water was heated above room ambient, the mercury lamp was being cooled below the temperature at which it would operate in air with no water circulation. The circuit actuated a relay providing "on-off" control to a heater in the water tank of the Interferometer.

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With the above set-up in the temperature controlled room, numerous variables were investigated. These included tank insulation, a fan to cool the tank, a stirrer, various types of pumps, water flow rates, location of the pump inlet, and insulating tubing for the water tubing.

TEST RESULTS

The most satisfactory operation was obtained with the exit temperature from the lamp coil at 108 degrees F. Temperature varied approximately ± 1 degree F. At this exit temperature the average water tank temperature was 107 degrees F in a room ambient of 72 degrees F. Cycle time was approximately 5 minutes on, and 5 minutes off. Under these conditions, a photomultiplier amplifier output signal voltage held within a total range of 0.25 volt. This value should be satisfactory. This value was calculated from measurements made at high photomultiplier gain which gave higher sensitivity to temperature variations."

The conditions of the apparatus were as follows:

A) The tank used was the existing plastic tank with holes drilled in the sides for insertion of the pump inlet and the heater.

B) Water flow rate - 4 ounces per minute.

C) Pump was a "Little Giant" centrifigual impeller pump. Little difference was observed with and without a stirrer when the pump inlet was located close to the heater, which it would be in the final design.

D) The fan was found not to be necessary under the above conditions.

E) Tubing length - 12 feet each.

We have assured ourselves that the approach taken is valid. We are presently modifying five (5) production Interferometers with the "fixes" and will retest these five production units to assure ourselves that the breadboard "fix" proves valid when production designed, engineered and produced. The production units are presently in the factory to be completed by September 16, 1966. The test program will begin on September 19, 1966, and will run for approximately two (2) weeks.

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We understand that [redacted] will visit our plant on September 21-22, 1966, and we have invited him to view the tests on these production units. It is felt that upon completion of these production units, modification kits can be made for all your Interferometers, and the modifications made in a relatively short period of time. We will keep you informed of our activities, as well as show the physical changes to [redacted] during his visit. 25X1A 25X1A

We appreciate your patience in this regard, and wish to again thank you for your assistance in bringing this matter to our attention. The results should be beneficial to all parties. If we can provide you with any additional information, please do not hesitate to contact us.

Very truly yours

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25X1A [redacted] #1237
REGISTERED

22 July 1966
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25X1A [redacted]
Assistant for Plans and Development, NPIC

25X1A [redacted]

We are in receipt of your letter of 8 July 1966 with reference to the Model 405B Chip Comparator. Be assured that the problems outlined in your letter have been paramount in our actions since originally brought to our attention. We have since begun a concentrated effort to correct stability with the interferometers.

We have been aware since March of this year that a problem existed, but did not know the extent to which it existed. As a result we have conducted several engineering analysis. As is nearly always the case in this kind of situation, the problems were not immediately apparent and to make matters worse, the stability problems do not exist on all equipments. Several machines which are in constant use have no problems at all. Unfortunately, the two specified in your letter, for some reason or other, have had recurring problems.

The difficulty seems to exist due to a drift condition in the interferometer and associated circuitry. The drift appears to be caused by temperature changes, but has also been noticed to exist as a function of time. The end result of this drift, as you are well aware, is counting errors or inability for the machine to properly operate.

We have been in constant touch with your technical people concerning this problem and they have been verbally informed of our activities and efforts in solving this mutually frustrating problem. We intend to continually inform your people and will proceed with immediate remedial actions as soon as we are convinced that the solution is a lasting one.

Below you will find a summary of an interim report on our activities in this direction.

GROUP 1
EXCLUDED FROM AUTOMATIC
DOWNGRADING AND
DECLASSIFICATION

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[redacted]

Contents of this analysis are classified company confidential process.

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I. Test Procedure

We selected three interferometers to assure that the test data collected will be representative of our production lot of equipments. An environmental room was specially instrumented for the purpose of running these tests. We can vary temperature in the room within the range of 68 degrees F to 90 degrees F. Data is being taken to determine drift with temperature as well as time. The sources of drift are being analyzed by measuring all three channels, the Photomultiplier output, Preamplifier output, and Differential Amplifier input, (which includes any drift effects of the [redacted] triggers). 25X1A
Also the RF oscillator performance was checked, as well as effects of line voltage variation on equipment performance.

II. Analysis of Data

A) Preamplifier

The preamplifiers were found to be stable in each channel of all instruments tested. Consequently, data readouts on the Photomultiplier were used in determining lamp performance.

B) Differential Amplifier

This, as well as the [redacted] trigger, was tested 25X1A
by varying the input to obtain the voltages at which the
25X1A [redacted] operates. It was found that the level drifted by approximately 0.06 volt/degree F. Two transistors were changed to silicon type 2N3628 and the drift was reduced to 0.0075 volt/degree F. A drift of 0.3 volts in the signal level is sufficient to cause trouble in the instrument. With the new transistors, a temperature change of 40 degrees F would be required to produce this drift. We feel the circuit is now safe and are proceeding with extended time tests.

C) Lamp

It was found that the lamp intensity was a fairly steep function of ambient temperature and cooling water temperature. As measurements were refined, lamp intensity was correlated with inlet temperature at the lamp cooling coil.

With controlled water temperature an ambient temperature range of 70 degrees F to 88 degrees F the maximum variation found in the output signals was 0.05 volts on any of the three channels. The lamp inlet water temperature varied from 57.5 to 59.4 degrees F during this test.

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25X1A [redacted] #1237

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This indicated that more precise lamp temperature regulation is necessary for the instrument. We then performed further tests to determine whether temperature regulation should be below or above ambient temperature. It was found that the ratio of peak to peak to average signals decreased with increasing temperature (as would be expected). However, this decrease was approximately 18%, so it is believed that regulation in the range of 80-85 degrees F should provide good performance with less complexity by heating above ambient rather than cooling below ambient.

III. Further Steps to be Taken

A) Measurement of illumination as a means of controlling water temperature will be checked. This is theoretically better than regulating the water temperature since it will compensate for long time variations of power supply and lamp within a limited value.

B) Heaters have been ordered and will be tested with the selected control means, by either temperature or illumination transducers.

C) When the control means is selected the system will be retested in its final form. Retrofit kits will be immediately released for production.

As I am sure you are well aware, this is a very tedious process due to the intermittent nature of the drift problem and the fact that it does not occur with all equipments. We must test, analyze the data, determine the difficulty, correct the difficulty, and retest to assure that the fix selected is the proper avenue of approach. We feel we have made excellent progress to date, as is evident by the interim report above.

Although the company will be on vacation shutdown for the next two weeks, a selected technical staff will continue with the test program and the modifications mentioned above, so that we will be able to conclude this program as rapidly as possible. It is our hope, as we have already mentioned to your group, that a final fix will be found by the end of August. As soon as we have obtained sufficient confidence in our data with the fixes installed, you will be notified.

[redacted]

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Let me assure you that this matter is of the highest priority and that we shall find a solution to the stability problem. Remedial action will be taken to install the fixes to your satisfaction.

If we can provide you with any additional information, please do not hesitate to contact me personally.

Very truly yours,

[redacted] 25X1A

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[redacted] [redacted]

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22 July 1966
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